# SCIENCE

FRIDAY, MARCH 2, 1888.

AT THE LAST MEETING of the Washington Philosophical Society, Mr. William Hallock presented a very noteworthy communication upon the formation of fusible alloys. Wood's alloy, which melts at about 64° C., is composed of lead, tin, cadmium, and bismuth, and the lowest melting-point among its constituents is 230° C. Mr. Hallock finds, however, that when the several metals are mixed together in filings, and exposed for twenty-four hours to the heat of an ordinary water-bath, the alloy is produced, and the mass becomes fluid. So, also, when freshly cut slices of sodium and potassium are simply pressed together at ordinary temperatures, liquefaction at once begins, and the fluid alloy is formed. In brief, it seems probable that the phenomena may be generalized, and that all fusible alloys may be obtained from their solid constituents at temperatures very slightly in excess of the melting-points of the compounds. Previous fluidity of either constituent is not necessary. It will be seen that these results bear directly upon the work reported by Spring, who claimed to obtain fusible alloys by pressure alone, but who neglected to prove that the temperature of his materials never at any point reached 70° C. Probably, also, Mr. Hallock's discovery may have decided bearing upon certain questions of molecular dynamics. His results are extraordinary, but it is more extraordinary that the phenomena had escaped notice hitherto.

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A WRITER on the psychology of acting, in *Longman's Magazine*, has introduced the inductive method into the solution of problems connected with the histrionic art. The question has often been debated, whether the effective personation of a part requires a real experience of the emotions concerned, so that it is acting only in the sense of artificially exciting a series of emotions; or whether the whole performance is a piece of art, with the emotions, or what to the audience shall stand for such, as entirely assumed as is the costume. The writer in question has addressed a circular upon this and allied topics to members of the actor's profession, and the majority of his answers decide in favor of the real emotion. The emotion of grief is taken as the typical one; and here the sad expression is, as a rule, not put on, but is the counterpart of a real sympathetic state. Real tears flow, often to the extent of interfering with distinct articulation; nor can the impression be at once shaken off upon leaving the stage. A pertinent instance is cited of an actor and an actress having to perform a touching scene many scores of times, and each night resolving 'not to make fools of themselves' by sobs and tears; but each night they broke down, and showed the reality of their emotions. Another actress is reported as saying that if she could play whatever piece most suited her humor each evening, her task would be a much easier one. The general verdict is, that the greatest success is produced by a real emotion. If one regards the performances of persons in the hypnotic condition as 'acting' in this sense, this is precisely the conclusion that the psychologist would expect. It is, however, not a universal experience, some actors testifying that their performance is almost entirely a planned, cool, intellectual artifice; nor are such actors absent among the 'stars' of the profession. That the assumption of a *rôle* can by repetition become sufficiently assimilated to be taken up by the automatic self, is shown by the experience of a very celebrated actress, who played the 'potion scene' in 'Romeo and Juliet' without knowing it, and could only with the greatest difficulty be prevented from playing the scene over again, so confident was she that she had not played it.

THE COMMITTEE on the geology of Rhode Island of the Providence Franklin Society has issued a valuable report on the geology of Rhode Island, including a useful bibliography of this subject, and setting forth briefly the various attempts made by the society to organize a thorough topographical and geological survey of the State. The committee was appointed in 1883, and we quote from its valuable report the following general remarks, which show the object of the work undertaken by the committee: "Our chief purpose has been to bring to the notice of the Franklin Society what has already been learned about the geology of Rhode Island. We have attempted little original investigation, but have tried to lay the foundations essential to future progress. The necessity for a collation of authorities is apparent to one who seeks to gain a clear idea of the geology of Rhode Island. Information is scattered through many publications. The Franklin Society endeavored to secure a new survey of the State in 1875–76, and again made an effort for a topographical survey in 1885–86; but thus far nothing has been accomplished. This report is published as the best contribution the society can make to the cause, — a step towards a complete survey; for a knowledge of what has already been learned is the proper foundation on which to build." It is to be hoped that the unceasing endeavors of the society to undertake a survey on a similar plan to that of Massachusetts, in co-operation with the United States Geological Survey, will be successful. In 1885 Governor Brown sent a message to the Assembly, commending such a plan, which involved two annual payments of three thousand dollars, but the Assembly did not act on it. The present publication, which is a valuable help to all students of the subject of the geology and geography of New England, we hope will help to show the necessity of undertaking a thorough survey.

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## IS THE RAINFALL INCREASING UPON THE PLAINS?

TO most of the inhabitants of that broad, billowy expanse which stretches from the Missouri to the Rocky Mountains, and from Canada to the Rio Grande, this question may seem unnecessary. It has so long been assumed by them as an axiom that the rainfall is increasing, that the opening of the question to discussion may appear like questioning the Copernican system. They have seen the frontier of settlement moving steadily westward, passing successively the limits set for it. Thirty years ago all the country west of the Missouri was considered as the 'Great American Desert,' in which, without irrigation, agriculture was an impossibility. But the stream of immigration has swept, with each succeeding year, farther and farther up the slope of the plains, driving the border of the desert before it. The 98th meridian was set as the boundary which the farmer could not pass, but now millions of acres are under cultivation beyond it; then the 100th meridian, but in Kansas and Nebraska the farms stretch scores of miles farther westward.

Progress has not, however, been uniform. Seasons of drought have checked it, and have depopulated temporarily large areas; but the settlers have returned to the charge, and have invariably won the day in the end.

To-day the cereals are being cultivated in Kansas, without irrigation, nearly to the west boundary of the State, in regions where the annual rainfall twenty years ago was less than twenty inches, — a region which at that time, as was generally agreed, could be rendered productive only by artificial watering. How has this been brought about? Have settlement and tree-planting induced greater rainfall, as is almost universally believed in this region, or are other causes involved?

Of course, if this westward extension of settlement has become

possible through an increase of rainfall, such increase must be of notable amount. The effect upon agriculture of a minute increase would be scarcely appreciable, and certainly would not suffice to produce the effects claimed for it, or to explain the wide-spread belief in this increase which is prevalent. In examining the rainfall records, we are, then, to look for substantial amounts of increase, — several inches annually. I would add that these records are now ample for testing this theory, and their testimony should be conclusive.

I find in this area twenty-six stations at which rainfall records have been kept for periods ranging from six to twenty-eight years, the total number of years of record being three hundred and ten. These stations are scattered widely over the area in question, from its eastern to its western border, and involve all stages of settlement. Now, if there has occurred an increase in the amount of rainfall, that of the later years of any series should, on the whole, be greater than that of the earlier years. I have therefore cut each of these series in the middle, and added up the rainfall of each half. These are presented in the following table, where the first column gives the names of the stations; the second, the number of years in the series; the third and fourth, the total rainfall in the first and second halves of each series respectively; and the fifth, the increase or decrease, the former being distinguished by the +, the latter by the — sign:—

| | | | | |
|---|---|---|---|---|
| Fort Leavenworth, Kan. | 28 | 518 | 525 | + 7 |
| Leavenworth, Kan. | 18 | 366 | 362 | − 4 |
| Manhattan, Kan. | 28 | 400 | 407 | + 7 |
| Lawrence, Kan. | 18 | 306 | 319 | + 13 |
| Fort Larned, Kan. | 12 | 131 | 119 | − 12 |
| Topeka, Kan. | 8 | 117 | 140 | + 23 |
| Dodge City, Kan. | 12 | 105 | 149 | + 44 |
| Wallace, Kan. | 6 | 50 | 59 | + 9 |
| Atchison, Kan. | 8 | 189 | 156 | − 33 |
| Baxter Springs, Kan. | 6 | 130 | 102 | − 28 |
| Burlingame, Kan. | 6 | 84 | 96 | + 12 |
| Council Grove, Kan. | 8 | 178 | 141 | − 37 |
| Fort Hays, Kan. | 6 | 55 | 79 | + 24 |
| Fort Riley, Kan. | 16 | 185 | 214 | + 29 |
| Olathe, Kan. | 8 | 201 | 194 | − 7 |
| Belleville, Kan. | 14 | 184 | 218 | + 34 |
| De Soto, Neb. | 6 | 109 | 80 | − 29 |
| Fort McPherson, Neb. | 6 | 58 | 52 | − 6 |
| North Platte, Neb. | 12 | 108 | 120 | + 12 |
| Omaha, Neb. | 18 | 319 | 337 | + 18 |
| Omaha Agency, Neb. | 6 | 75 | 78 | + 3 |
| Yankton, Dak. | 12 | 170 | 178 | + 8 |
| Bismarck, Dak. | 12 | 140 | 102 | − 38 |
| Fort Benson, Mont. | 6 | 34 | 40 | + 6 |
| Cheyenne, Wyo. | 16 | 84 | 98 | + 14 |
| Denver, Col. | 14 | 112 | 103 | − 9 |

It will be seen at once that the individual results are contradictory in a high degree; those from sixteen stations showing an increase, while ten stations show a decrease. These contradictions, which are due to the irregularity of the rainfall may, however, be in a measure eliminated by combining the results, under the supposition that the change, if any, has been a progressive one. Under this assumption, the sum of the earlier halves of the different series should be less than that of the later halves. Adding them together, it is found that the aggregate rainfall at all the stations was, in the first half of the series, 4,408 inches, and in the second half, 4,468 inches; showing that there has apparently taken place an increase of 60 inches in the total amount of rainfall at all these stations in a total of 310 years, or, to put it in another form, there has fallen in each year of the second half of these series 0.4 of an inch more rain than in the first half. It is unnecessary to add that this is not the sort of increase for which we were searching, as an increase of but a fraction of an inch certainly could not produce the results which are claimed. An examination of the seasonal distribution of the rainfall shows that that also has undergone no material change since settlement began in this region. We may therefore dismiss as baseless the popular idea of an increase in rainfall, either annual or during the growing season, and look elsewhere for an explanation of the phenomena of settlement which the plains present.

The early explorers, of the time of Fremont and the Pacific Railroad surveys, based their judgments of the capabilities of the country for agriculture upon the character of the natural products, the absence of trees, the presence only of sparse, hardy grasses, the cactus, and the yucca. Their judgment was a mistaken one, as events have amply proved.

Since their time physical geographers have set arbitrary limits to safe farming without irrigation, basing their reasoning upon the known rainfall of the region, and that supposed to be required for the average farm product. Subsequent experience has shown that a much smaller quantity of rain is essential than was supposed. To my mind, there is little more to be said. If it be found, that, with an annual rainfall during the growing season not greater than ten inches, farming can be carried on successfully, the only question remaining is, how the mistake could have been made of supposing that it required a greater amount.

There is no doubt that cultivation adds greatly to the economy of the rainfall. The surface of the plains in an uncultivated condition is mainly bare, hard ground, but slightly protected by its covering of grasses. From such a surface the rain flows off freely, and an unusually large proportion of it finds its way into the streams, while a correspondingly small proportion sinks into the ground. The farmer, with plough and harrow, changes all this, and retains in the soil most of the rainfall. From year to year the supply in the soil increases, so that the subsoil becomes in time a reservoir from which the surface soil may draw in times of drought. Furthermore, the scanty vegetation offers little protection against evaporation, which is excessive upon the barren plains; but the ampler mantle which cultivation spreads over the soil prevents its moisture from disappearing in the atmosphere with so great rapidity.

How much farther westward into the arid region can the farmer push? This is a very important question, affecting the value of millions of acres of land; for, if this land can be cultivated only by the aid of irrigation, nine-tenths of eastern Montana, Wyoming, Colorado, and New Mexico, together with western Dakota, Nebraska, and Texas, must be given over to the cattle-men in perpetuity, as the streams are entirely insufficient for irrigation. A conclusive and satisfactory answer can be given only by the farmer

HENRY GANNETT.

## WASHINGTON SCIENTIFIC NEWS.

A Novel Way of Forming Alloys. — The Constituents of Sugar. — Rainfall in the Arid Regions. — Irish Myths and Folk-Tales. — Examining Fats.

### The Formation of Alloys.

THE following is an abstract of a note read before the Philosophical Society by William Hallock, of the United States Geological Survey, Feb. 18, 1888:—

In the *Berichte der chemischen Gesellschaft*, vol. xv. 1882, pp. 595–597, W. Spring describes the formation of alloys by submitting the filings of the constituent metals to high pressure, without appreciable rise in temperature. Wood's alloy of cadmium, tin, lead, and bismuth he produced by mixing proper weights of the filings of these metals, and subjecting them to a pressure of 7,000 atmospheres. The block thus obtained was again filed up, and subjected to the same pressure.

In this way a block of metal was produced which possessed the physical properties of ordinary Wood's alloy, formed by melting the mixed constituents.

W. Chandler Roberts repeated this experiment (*Chemical News*, vol. xlv. 1882, p. 231), and verified Mr. Spring's results.

In seeking an explanation of the above phenomenon satisfactory

to myself, I reasoned, that if at any time during the first compression, the subsequent filing, or the second compression, anywhere throughout the mass, the constituent metals were in contact, at that point there would be a minute globule of the alloy, — a molecule of alloy, as it were. If, now, the temperature of the block, either during compression or subsequently, be raised to 70° C., then that molecule of alloy will fuse, and act as a solvent upon the surrounding metals till the whole mass is fused.

If my idea was correct, I concluded that perhaps I could produce the result without pressure, giving more time and an appropriate temperature to the substance.

The filed metals in the proper proportions were mixed, and packed into the bottom of a 'sealed tube,' such as is used for blowpipe work, using no greater pressure than could be conveniently exerted with a piece of wire, one-eighth of an inch in diameter, held between the thumb and finger. This tube was hung in the water-bath of the laboratory over night (eighteen hours), thus maintaining it at a temperature of from 98° to 100° C. On examination, the filings had settled down considerably. The tube was then struck upon the table, jarring them down still more, and in an hour or two the whole was a molten globule. The experiment was repeated, using larger quantities packed in with a lead-pencil, and occasionally pressing the mass together with the pencil, producing twenty or thirty grains of alloy. Since then, tin and lead have been fused together at 200° C., tin melting only at 230° C.; also sodium and potassium at ordinary temperatures (20° C.), the first melting at about 90° C., and the latter at about 60° C. Thus I proposed the law, that *an alloy can be formed out of the constituents at a temperature above the melting-point of the alloy, although it be far below that of any constituent, with no (appreciable) pressure.* The extended verification of this law, as well as the electrical and thermal phenomena associated therewith, will be the subject of a work which I hope soon to undertake and carry through.

### The Chemistry of Sugar.

The following is an abstract of some remarks made by Prof. H. W. Wiley, of the Agricultural Department, at the meeting of the Chemical Society, held Feb. 9. Referring to his recent work in Louisiana, he said, "When the cane is subjected to pressure analysis, it is found that the juice differs from that in the ordinary bagasse. There are two kinds of juice in the cane, — one stored in the cells, and the other in the circulation. The juice oozing from the end of the cane, at first, from compression, is like water, and has no sugar, so far as the taste goes." Another subject of investigation had to do with the determination of the total solids in the juices, which is a difficult problem. It was fully demonstrated that the saccharometers in use are not reliable, because they are mostly graduated to pure sugar solutions, while in the cane juices there is a mixture of various solutions. Professor Wiley described the process he used of drying to obtain the total solids, and his method of determining them by the addition of alcohol and the use of paper coils. He also said, in regard to the genesis of sucrose, that it had been proved beyond doubt that it is a direct formation, and not a secondary product. All the facts are against the old theory that starch is formed first, and the sugar from it. The sugar in the circulatory sap is never a starch sugar, and cannot have come from starch. It is found in the leaf, and is formed by the aid of chlorophyl. He also described the polarizing instrument, and said that many improvements have been made in it. Another point developed is that the amount of available sugar in the cane is greater than it has heretofore been supposed to be. In closing, he said that many of these points had been indicated in his previous work, but were emphasized by his recent investigations.

### Rainfall beyond the Mississippi.

Gen. A. W. Greely, chief signal officer, gave to the Washington Philosophical Society, at its regular meeting, Feb. 18, the partial results of a study he is now engaged upon of the rainfall in the trans-Mississippi region. He had before him a number of maps upon which had been charted the observations which were the basis of his study, and referred to them constantly as he spoke. He said that the idea that there is any part of the West that is absolutely rainless is now a banished myth. During the past ten years the number of stations for observation has been doubled, so that there are, in twelve States and Territories, nearly one hundred stations; and the observations, if reduced to a single one, would cover a period of nearly five thousand years. The result of charting these observations has been to reduce very greatly the areas of small rainfall. The area in which the annual precipitation was supposed to be less than five inches has almost disappeared, and that in which the rainfall was put down at less than fifteen inches has been reduced by a quarter of a million of square miles since the Census map of 1880 was made.

General Greely discussed the question of what constitutes an arid region, and said that he does not agree with Maj. J. W. Powell, who placed the minimum amount of precipitation necessary for successful agriculture at twenty inches per annum. He said that millions of bushels of wheat are raised every year where the rainfall is less than twenty inches, and referred to the statistics of Dakota, where more than 2,600,000 bushels were raised in the two counties of Richland and Stutsman in 1885, and 1,500,000 in 1887, with an average rainfall of 13.7 to 15.1 inches.

General Greely also mentioned the interesting fact, that, while the rainfall increases as the rivers which flow directly into the Gulf of Mexico or into the Pacific Ocean are followed up from their mouths, it increases with the distance from the mouths of such as empty into other bodies of water, like the Colorado.

General Greely's charts also prove that much of the rainfall in what has been known as the arid region, and where it was formerly supposed that the precipitation was five inches or less, was not reported. In some of these places the actual rainfall is as much as sixteen inches, and in one it is thirty-seven. This explains why water is found so abundantly in wells in some parts of southern California, where the annual rainfall has been reported as ten, twelve, and thirteen inches: the actual precipitation is twenty-four inches.

General Greely said that he had caused to be placed upon the charts the maximum and the minimum rainfall of the various stations, not expecting that they would indicate any thing, but that the curves were almost as regular as those on the annual maps. He explained that the small average amount of rainfall formerly reported was due in part to the fact that so large a number of stations had been situated along the line of the Pacific Railroad, which, seeking low gradients, had been built through a section of country in which the precipitation was small. He spoke also of the prevalent opinion that the rainfall in the West is increasing, and said that he thinks this opinion to be correct, and closed with the remark that it was not fair to treat that country on the basis of seasonable rains, since the larger portion of the precipitation took place during different months in different sections of the region.

In the brief discussion which followed the address, Prof. G. K. Gilbert said that it was not safe to fix any given amount of rainfall as the minimum necessary for successful agriculture, without qualifications. Very much depends upon the time when the rain falls, and the rapidity with which evaporation takes place. More rain is required in Arizona than in Dakota, and many unsuccessful agricultural experiments have been made in Utah near Camp Douglass, where the annual precipitation is as much as eighteen inches.

Professor Fernow said that he had compared the amount of rainfall during the five months of vegetation, in Philadelphia, Buffalo, Dodge City, and North Platte. It ranges from fifteen to seventeen inches, the largest amount of precipitation being at North Platte. There was no lack of rainfall at the eastern stations, but at North Platte it was impossible to raise a crop. He learned also from Utah that the amount of water needed to irrigate land there was less after two or three years than when it was first turned on.

Prof. C. V. Riley spoke of the frequency and violence of the rainfall as modifying in an important degree its effect.

### Folk-Lore of Ireland.

The following is an abstract of a paper read before the Anthropological Society of Washington, Feb. 12, by Jeremiah Curtin: —

For many years I have believed that there was a great stock of myths and folk-lore current among the people in Ireland, as well as an abundance of that class of facts which throw light on the history of the human mind, — facts which would be valuable to the scien-

tific world, and highly prized by this Anthropological Society of Washington. I know that there was a large body of manuscript Gaelic literature of considerable antiquity and of high value, especially that portion of it devoted to mythology, heroic tales, chronicles, and law tracts. I hoped, also, there might still remain in the minds of the people of the remote districts of Ireland many idioms useful in explaining the language of the manuscripts, and many myths and tales that would supplement and strengthen the recorded mythology. I went to Ireland last year, therefore, for the purpose of settling this question by actual investigation, and my first step was to make the acquaintance of the few Gaelic scholars in Ireland, and examine the manuscripts preserved in Dublin.

These manuscripts fill about two thousand volumes, are kept in the Royal Irish Academy and the University of Dublin, and are of various kinds, — histories, chronicles, treatises on law, medicine, astronomy, etc. Among them, and of chief interest to me, were the manuscripts containing the myths and heroic tales of the Gaelic people. These myths and tales, if printed, would fill about ten thousand quarto pages. This is the greatest collection of myths in Europe. It is perfectly unique, both in quality and quantity. Neither in ancient nor modern times had any nation on the mainland of Europe such a collection; and O'Curry very truly said that the single 'Book of Leinster,' if published to the world, would make the reputation of any nation.

The 'Book of Leinster' is but one of many books of its class, though it is the richest of all in contents; and the 'Book of Leinster' is not yet accessible to the world, though it has, with three other volumes, been placed within the reach of a few Gaelic scholars in the form of some *facsimile* copies of the original manuscript, with all the contractions and abbreviations, of which several hundred were used by scribes in the days before printing. Some of the most important of the Gaelic manuscripts of myths and tales have come to us in unique copies, while a great many others of equal value, known by title or extract, have perished. Merely a wreck, a remnant of the old time, has been saved; but it is a wreck so extensive as to excite real wonder and thankfulness.

It is a matter of deep interest, also, to the scientific investigator, to learn that the chronicles of the country, both lay and ecclesiastical, especially the latter, bring to light a great many phases and forms of thought of pre-Christian times of which we have no record elsewhere. There is no church history in western Europe so valuable in this respect as that of the Church in Ireland; for the conversion of the people was voluntary, and the country at that time, and for some centuries later, was free from foreign pressure of every description. All of the ancient beliefs and practices that could posbly be permitted, were permitted. Some of these lived on parallel with the Church, and others were incorporated into it.

After a brief visit in Dublin, where I found assistance, and a most agreeable hospitality from the members of the Royal Irish Academy, the University of Dublin, and the two Gaelic societies, I set out to visit remote places in the west. Without entering into any detailed account, I may state that I visited some of the characteristic and secluded parts of the west coast, and took down personally a large body of myths and stories, some very long, others not so long. This collection of materials is sufficient to fill a couple of twelvemo volumes, and will give some idea of what yet remains in the Celtic mind of Ireland. It is, however, but a small part of that mental treasure still in possession of the people.

One of the largest and finest groups of Gaelic myths is the Ossianic, or myths of Fin MacCumhal and the Fenians of Erin. Fin has his immediate personal attendants. He and they possess fixed and well-determined characters, and their names and exploits are familiar to all who have heard the tales of the Fenians of Erin. There are no stories more popular, and they are interlaced with a great number of other important myths of various descriptions. Every place in the land has witnessed the activity with which Fin and his men struggled with every manner of obstacle, and fought with every kind of foe. Fin and Oisin, according to the stories, were born in a great many places in Ireland. Scotland is as full of their activity and birthplaces. Glencoe, the scene of the celebrated massacre, is a birthplace of Oisin. The account given of how these Fenian or Ossianic stories were preserved is remarkable enough. The authorship of them all is attributed to Oisin, the son of Fin MacCumhal, who told them to St. Patrick. St. Patrick had them carefully written down; but he found them so agreeable and entertaining, as well as so numerous, that he said people would neglect their work and do nothing but listen to these stories, so he destroyed two-thirds of what was told him by Oisin. From the remaining one-third come all the tales of the Fenians now current in Ireland and Scotland. In one of the stories which I collected is a complete account of how Oisin came back from Tir nan Og (the land of youth), after he had been there three hundred years, and told them to St. Patrick.

The time is coming when mythology may become a science, if scholars will work to that end, but mythology is far from being a science yet. There are many theories and loose statements current about mythology, — 'disease of language,' 'sun myths,' 'serpent myths,' etc., — but there is no science in all this. It is fancy, guess-work, efforts of men dealing with insufficient and unsatisfactory materials, collected, in many cases, by incompetent hands or by persons who tamper with materials for the purpose of improving them, or fitting them to some theory.

There is probably no more striking or interesting case of error than that of Max Müller, who has founded a whole theory of mythology on what he calls a 'disease of language.' Now, Max Müller's 'disease of language' is merely an incident in the history of mythology, instead of being, as he makes it, the great central and germinal factor, the parent instead of attendant of mythology. Müller's error is one that could never have been made by a man having proper and sufficient materials at hand from mythologies still intact. The things we need, above all, at present, to advance mythology on the way to becoming a science, are *facts*, and facts in mythology are well-preserved myths. These we need in great number, and in all the variants attainable in each linguistic stock of people.

Among the different branches of the Aryan race in Europe, there is none, as I have already stated, having so extensive and well-preserved a mythology as the people of Ireland. This mythology is to be found in two places, — in Gaelic manuscript, and in the minds of the people of the more secluded parts of the island. Only very small portions of the Gaelic manuscripts have been translated, and still smaller portions published; so that practically this body of material for science is unknown to the world. The work of utilizing it remains to be done. Now, it will be found that the manuscript material can never be properly translated and explained without a knowledge of the words and idioms of the language, as well as the ideas and myths that are in the minds of the Gaelic-speaking people of Ireland.

### The Qualities of Fats.

The chemist and microscopist of the Department of Agriculture are engaged in an examination of samples of the lard of commerce, for the purpose of determining its constituents, and also of discovering the best tests for adulteration. Professor Wiley has employed all of the ordinary tests, but gets the best results from one suggested by an Italian chemist, Bechi, in which nitrate of silver is used. Cottonseed-oil, when brought in contact with nitrate of silver, reduces the latter to a metallic state. Professor Wiley has also begun an interesting series of experiments to determine the refraction of different oily substances. The instrument used is Abbé's refractometer, which shows the index of refraction upon a scale upon its side. There is no literature on this subject, and the tables which Professor Wiley proposes to make will be an interesting contribution to the present knowledge of the qualities of fats. X.

Washington, D.C., March 1.

## HEALTH MATTERS.

### Transmission of Infection by Rags.

THE 'Eighteenth Annual Report of the State Board of Health of Massachusetts' contains a valuable report by Dr. C. F. Withington, who was requested by the board to investigate the question of the transmission of infectious diseases by means of rags. Dr. Withington's report is very full and complete, and is a very fair and unbiassed statement of the facts as we understand them. His conclusions are as follows: —

1. Small-pox has been transmitted through the medium of rags in a certain number of cases, small in proportion to the whole number

of persons who handle rags, but absolutely numerous enough to show that unvaccinated workers in rags are exposed to an actual, if not imminent, danger of infection from this source.

2. The source of this infection is more frequently domestic than foreign rags, though the disease has been caused by the latter. This possibility of infection through imported rags accords with what is known of the tenacity of life of the variolous poison.

3. Among the rarer means whereby cholera is transmitted are textile fabrics infected with choleraic discharges. There is evidence that clothing from cholera patients, and possibly clothing merely packed in an infected locality, has, when transported to a distance and there unpacked, caused the disease in those who have handled it, thus starting a fresh cholera focus. A proper distinction exists between clothing, on the one hand, recently removed from the body, and again, not long after, put on to the body; and rags, on the other hand, which, if transported to this country, are certain to have undergone a carefully discriminative sorting and drying, and to have spent a considerable time in warehouse and on ship-board.

4. The statement that cholera has been transmitted by paper-rags rests upon a solitary case, of which the details are not complete, and on the reliability of which some of the highest authorities on cholera have cast doubt. If the case be accepted, it is one of infection by *domestic* rags, carried only fifty miles from their place of collection.

5. An epidemic affection, known as 'rag-sorters' disease,' appears to have broken out on three or four occasions in European paper-mills. It was probably, though not certainly, the disease called 'anthrax.'

6. Authenticated instances are not to be found in which the other infectious diseases — typhus and typhoid fevers, scarlet-fever, measles, and diphtheria — have been transmitted through rags; though it is to be said that such evidence, supposing the fact to exist, would be very difficult to get. Neither do the mortality tables, as shown by registration reports, show a preponderance of deaths from these diseases in the paper-making towns.

7. There is no evidence to show that rag-sorters as a class are, except for occasional cases of small-pox and a certain amount of pulmonary irritation from the dust of improperly ventilated rooms, less healthy than other persons engaged in in-door manual occupations.

8. Despite the fact that cholera is not known to have ever been conveyed to this or any other country in foreign-baled rags, it is a reasonable precaution to prohibit the landing in any United States port of rags gathered in epidemically infected localities, in view of the possibility that among such rags there may have been thrown articles of infected clothing which have not been sufficiently dried and aired, or have not occupied enough time in their transportation to be devoid of danger. Such prohibitions should be limited to the time and place of epidemic infection; but all necessary precautions should be taken to make sure that rags shipped from a healthy port were not gathered or baled in an infected place.

9. As the only safeguard against the occurrence of small-pox among operatives, paper-mill owners, whether 'incorporated companies' within the purview of the statute or not, should make evidence of successful vaccination an absolute prerequisite to the employment of any person in the mill, and a re-vaccination at regular intervals (not merely on the occurrence of an epidemic in the neighborhood) a condition of being retained in their employ.

10. As the contagion of small-pox, phthisis, and perhaps other diseases, is capable of being inspired when the particles carrying it are suspended in the air in the form of dust; and as dust, even when it carries no contagion, is irritating to the respiratory passages, — every mill should have, in connection with each table in the rag-room and in the dusting-room, a ventilating system, preferably consisting of flues connected with an exhaust-fan, so that the dust, as fast as it is disengaged, may be withdrawn from the air. The success which attends the working of such an apparatus, in some mills where it is in use, is a sufficient warrant for its general introduction.

11. A law similar to that of Great Britain (Section 125 of the Public Health Act of 1875), imposing a penalty on the selling or giving-away of infected rags from persons sick with any dangerous disease, seems desirable. Public institutions and private householders should be obliged (and not, as at present, simply advised) to insure the disinfection of the more valuable articles, and the destruction by fire of all rags, that have been thus exposed.

12. As domestic rags comprise more than half those used, and represent a still larger proportion of the infection likely to be carried, it follows that they should participate in whatever disinfection is thought necessary. This fact points to the paper-mill as the proper place for making such disinfection. The sulphur process would doubtless afford the least embarrassment to the manufacturer; the bales being opened in a tightly closed room, the rags being spread on racks, and sulphur burned in the proportion of two pounds to each one thousand cubic feet of space. The introduction of steam under pressure, the rags being similarly disposed, would be the most effective disinfection possible, but would dampen the rags to their injury, unless the moisture were dried out at once with a current of hot air.

ELECTRICAL BULLET-PROBE. — At a recent meeting of the New York Academy of Medicine, Dr. Girdner of New York exhibited his telephonic bullet-probe. The interesting feature of this probe is that it is operated by a current of electricity extracted from the body of the patient himself, in whom it is desired to locate a metallic missile. The construction of this probe is as follows: to each of the two terminals of a telephone-receiver, an insulated flexible wire about four feet long is connected. At the free end of one of these wires a hollow, bulbous piece of steel is attached. At the free end of the other wire is a suitable handle in which a probe may be placed, and held by a clamp-screw. The internal arrangement of the handle is such that a perfect electrical contact exists between the end of the probe and that of the wire which terminates in the handle: the same is true for the end of the other wire and the steel bulb. When a current of electricity is passed through the coil in the receiver by means of the bulb and the probe, each time that the current is made and broken a clicking or rasping sound is heard in the receiver held to the ear. All sounds are shut out except that heard when the bullet is touched; and the apparatus is so constructed that both hands are left free. In describing the application of this probe, Dr. Girdner mentioned a case seen in practice, in which a musket-ball had lain between the bones of the leg for twenty-two years. When an ordinary probe was passed, hard substances could be felt in many places, but it could not be told whether they were bone or bullet. The porcelain probe, invented by the distinguished French surgeon, Nélaton, was of no use, as the bullet was so covered by a thick crust of salts of lead as not to be marked when it was rubbed against the bullet. When the telephonic probe was passed, no response came so long as bone and other tissues were touched; but, the moment the probe came in contact with the bullet, a clicking and rasping sound was heard in the telephone. During this test the steel bulb was held in the patient's mouth. A more detailed description of the probe, with illustrations, may be found in the *New York Medical Record* of Feb. 4, 1888.

MEDICAL COLLEGES IN THE UNITED STATES. — The last annual report of the State Board of Health of Illinois contains some very interesting statistics in reference to medical education in the United States. Since 1886 there have been two new medical colleges established, and two have ceased to exist. There are now 114 colleges which exact an educational requirement of intending matriculates, as against 45 formerly, there being no change in this respect from the previous year; 43 colleges now exact attendance upon three or more courses of lectures, as against 22 formerly, — being a gain of two over 1886, — and 57 others make provision for a three or four years' graded course. Hygiene in now taught in 114, and medical jurisprudence in 112 colleges, as against 42 and 61 respectively prior to 1883. There is an increase in the average of lecture-terms from 23.5 weeks to 24.9 weeks during this period; and 114 colleges now have terms of five months or over, and 63 have terms of six months or over, as compared with 101 and 42 respectively. There is only one medical college that has a course less than twenty weeks, the Medical College of Georgia. In 1882–83, out of every 1,000 matriculates, 322 were graduated, taking both the United States and Canada and all schools of practice into the account. In 1886–87 only 294 out of every 1,000 matriculates

were graduated. In the United States alone, in 1882–83, out of every 1,000 matriculates, 331 were graduated, while in 1886–87 only 305 out of every 1,000 matriculates were graduated.

THE FUTURE OF MEDICAL GRADUATES. — Of some one thousand graduates from collegiate institutions, says the *Pacific Record*, seventy-five only make for themselves a name and prominence in their calling. About two hundred, having business qualifications, become rich by their practice and by judicious investments. Four hundred abandon, in whole or in part, their profession for some more lucrative business; and the balance struggle with mediocre ability for a bare subsistence, and a wearying effort to keep up an appearance before the people.

ALCOHOL AND FEVERS. — Dr. Kretzschmar of Brooklyn read a paper at the recent meeting in Albany of the New York Medical Society, on the use of alcohol in certain forms of fever. He believed that in some diseases alcohol, if properly administered, was not only instrumental in prolonging life, but was frequently a most potent factor in preserving it. Alcohol possesses the qualities of both food and medicine. It is one of the best antiseptics, and the most reliable remedy we have in the treatment of diphtheria. He regarded alcohol as beneficial in the treatment of phthisis, especially when the temperature of the patient was increased. In the discussion which followed, Dr. Castle advised that stimulants be kept in several small bottles, as, when exposed to the air, they lost valuable medicinal properties.

BOVINE TUBERCULOSIS. — Dr. Brush of Mount Vernon discussed at the Albany meeting the subject of bovine tuberculosis. Of all domesticated animals, the bovines are the most subject to tuberculosis. Five per cent of the cattle in England are affected with tuberculosis, and it is said that twenty per cent of the cattle in some of the thoroughbred Jersey herds in the Northern States are similarly affected. He believed that more human beings were not infected, because the normal temperature of the human race was so much lower than that of the bovine, — 98.5°F. in the one, and 101° to 103° F. in the other; this latter temperature being necessary for the growth of the germ of the disease. The cultivation of tuberculosis in animals confirms this view, as resistance to the disease decreased as the normal temperature of the animal increased. Thus, in the dog, resistance was good, while in the common fowl it was *nil*. Dr. Brush thought that the Federal Government would do better to spend its money in the investigation and suppression of this disease, than to appropriate five hundred thousand dollars to stamp out pleuro-pneumonia, which did not affect the human race. He believed, that, if bovine tuberculosis were eradicated, it would soon become eliminated from the human race, and he thought that physicians should strive to procure laws which would accomplish this.

## ELECTRICAL SCIENCE.

### Secondary Batteries.

IT has been for many years the dream of inventors to perfect some apparatus by which energy could be stored, to be used when occasion required. The secondary battery accomplishes this better than any thing else that has been invented, but it has limitations and defects that it is well to point out.

The two principal uses, with a great number of minor applications, to which secondary batteries can be put at present, are the distribution of energy for electric lighting, and their use in driving street-cars. As for the first of these, it is well known that the direct system of constant potential distribution cannot be employed at any considerable distance from the central station, owing to the heavy investment in copper necessary. If storage-batteries could be economically used, however, they could be distributed at different points through the district, to be lighted and charged by a high potential current, allowing comparatively small conductors to be used, and employing the electric plant during the day, when it would otherwise be idle.

The advantages for street-car work are apparent: each car carries within itself the energy necessary for running it; a break-down of one car does not affect the rest of the system. Compared with other electrical systems, the advantages are, that it can be used in crowded streets with no danger from high potential currents; and where a large number of cars are used, it is much simpler than any other plan. Compared with cables, it gives a greater economy of power, a less first cost, and the impossibility of one accident disabling the whole line.

The disadvantages of secondary batteries are the cost, the waste of energy, the deterioration, and the weight for a given capacity and rate of discharge.

The type of storage-cell most generally in use is some modification of the Faure cell, generally of the Faure-Sellon-Volkmar type. In it the plates are made of cast lead supports or 'grids,' into which is pasted a mixture of red lead and sulphuric acid. The 'grid' has in it square hour-glass shaped holes, the contraction in the middle being intended to prevent the active material from falling out. The plates pasted with red lead are put into dilute sulphuric acid, alternate plates are connected together, and an electric current is sent between the two sets, changing them into pure lead and lead peroxide. Plates thus 'formed' are put into cells with dilute sulphuric acid, a number of lead or negative plates, and peroxide or positive plates, in each cell. This is, very briefly, the general method of manufacture.

Now, suppose we have one of these cells fully charged, — all of the positive plate peroxide, all of the negative plate lead, — and discharge it through a resistance. At first the electro-motive force is over 2 volts. This will rapidly run down to about 1.95 to 2 volts, where it will remain constant (provided we do not discharge the cell too fast) for a considerable time, when it will begin to fall, and, if we continue the discharge, it will finally become zero. If, now, the plates be analyzed, it will be found that the positive plate has in it peroxide and sulphate of lead, the latter perhaps fifteen to twenty per cent of the whole active material. The negative plate will consist of pure lead and sulphate. If we charge the cell, the plates will be changed to pure lead and peroxide again, the electro-motive force will gradually rise to 2.25 volts, and, when the charge is nearly complete, oxygen will be given off from the positive plate. There are two very important things to be noticed. If we charge and discharge the cell a number of times, we will find that the energy we get out of the cell is less than the energy we put in by an amount that varies with the rate of discharge, the efficiency being less as the discharge rate is greater: the average efficiency for the present storage-cell is something near seventy per cent. Another point even more important than the first is, that, if we greatly increase the discharge rate, the electro-motive force of the cell will fall rapidly; and if we persist in this, the plates will corrode and buckle, and the plugs of active material will fall out of the holes in the plates. There is one more disadvantage besides these, and that is the fact that the life of the cell, especially that of the positive plates, is limited. Under favorable conditions, the positive plates will last, on the average, two years: the negative plates will last much longer.

For lighting, the most important disadvantages are the cost, the loss of energy, and the deterioration. The fact that the cells cannot be discharged at more than a certain rate does not greatly affect their usefulness in ordinary cases. And storage-batteries have reached such a state of development that it is safe to say, that, if they were sold and repaired at reasonable prices, they would have at once a great field of usefulness for electric lighting, even with their present defects. The principal cost of a storage-cell is for material: the cost of the labor is comparatively small, and, when the plates have given out, at least a part of the material is left.

But for traction-work the greatest disadvantage is in the slow discharge rate permissible. At present from three thousand to four thousand pounds of storage-batteries are required to drive an ordinary car, the storage capacity being enough for a run of from forty to sixty miles. This great weight increases the power necessary to run the car, the wear of the track, and the deterioration of the car. Besides, it means a considerable first investment, and a large battery to be kept in repair. If we could discharge the battery at any rate we wished, we could make a round trip with seven hundred and fifty to one thousand pounds of battery. We would have to charge our batteries oftener, of course, but we would greatly decrease our items of first cost, depreciation, wear of road-bed and cars, and even of power expended.

It has been variously estimated that the difference of expense be-

tween horses and the storage-battery, including every thing but the deterioration of the battery, is from one to three dollars per car per day in favor of the battery. Taking a well-known form of battery as a type, supposing fifty per cent over the cost of manufacture is charged for the cells, and estimating the cost of horse-power for one of the New York street-railways: the difference of cost of the two systems is roughly two dollars and a half per car per day. Now, whether the repairs of the battery will cost this much is a matter that only experience can settle, but on roads where the grades are slight it is very probable that the batteries will be most economical.

The matter at present stands thus: only about fourteen per cent of the possible storage capacity of storage-cells is utilized; their discharge rate is limited, so that even this comparatively small capacity is great in comparison to it; the cells deteriorate, so that a large item of expense is in repairs; the efficiency of the cells is not greater than seventy per cent. Even with these disadvantages, storage-batteries can be largely applied for lighting and traction-work. It seems impossible, with the number of investigators working on the subject and the great possibility of improvement, that the next few years will not see a great increase in the economy, storage capacity, and discharge rate of storage-cells; and a very moderate increase in any of these, especially the latter, will throw the balance decidedly in their favor for traction-work. For lighting, their field is equally extended.

PRIMARY AND SECONDARY CURRENTS IN INDUCTION-COILS. — The relations between the primary and the induced secondary currents in induction-coils have been investigated mathematically by several writers, the clearest and most satisfactory treatment being probably that of Mascart and Joubert. Since the experiments of Ewing on the magnetization of iron, it has been clear, not only that the assumptions hitherto made have not accurately represented the facts, but that any rigorous mathematical treatment would, with our present knowledge, be impossible. The work of Prof. Galileo Ferraris in this connection is important as showing the extent of the modification that can take place. He has determined experimentally the difference of phase between the primary and secondary currents in an old-type Gaulard and Gibbs transformer, and, comparing them with theoretical deductions of his own, finds the agreement satisfactory. The objections to his work seem to be that the apparatus he experimented on is obsolete, and is not of the type at present universally used; the old transformers having an open magnetic circuit, while now the magnetic circuit is always closed. The work is important, however, as showing the inadequacy of the at present accepted treatment.

## ETHNOLOGY.

### Notes on the Kwakiool of Vancouver Island.

DR. GEORGE M. DAWSON gives in the Transactions of the Royal Society of Canada for 1887 a very interesting sketch of the Kwakiool, a people inhabiting the central part of the coast of British Columbia. He describes the numerous tribes of this nation and their several villages, but the most interesting part of the paper is a description of their mode of life, traditions, and language. They live in large wooden houses, the front of which is painted with designs representing the fabulous thunder-bird, whales, snakes, or salmon, while the posts and beams supporting the roof are carved in similar forms. The children are for a long time kept tied into the cradle. When they leave it, the cradle and the bedding must be deposited at a place reserved for this purpose. Then a great festival is celebrated, and the child is given a name. On this occasion the father has to give away a great part of his property. Dawson gives very valuable information on this giving-away of property, which was well known to be practised by the tribes of the north-west coast, but the meaning of which was not clearly understood. He says, —

"The rules governing the *potlatch* (as this festival is called in the Chinook jargon) and its attendant ceremonies have grown to be so complicated that even those persons most familiar with the natives can scarcely follow it in all its details, and it is sometimes difficult for the natives themselves to decide certain points. The custom was formerly almost entirely confined to the recognized chiefs, but of late years it has extended to the people generally, and become very much commoner than before. It is regarded as a means of acquiring and maintaining prestige and power, but it has nowadays spread to all classes of the community, and become the recognized mode of attaining social rank and respect.

"As a particular instance of the custom, let us suppose that a man of one tribe has collected together as his own, or obtained control of, say, five hundred blankets, and wishes to make a *potlatch* to some other tribe. He goes to its village, and makes known his intention of distributing a thousand blankets at a certain date. He begins by lending out his stock of five hundred blankets, giving larger numbers to those who are well off. This loan is reckoned a debt of honor, to be paid, with interest, at the proper time. It is usual to return two blankets for every one borrowed. Thus the stranger obtains the thousand blankets for his *potlatch*, which, with the accompaniment of much bombastic speech-making and excitement, are distributed in exact proportion to the social position of those taking part."

Those who receive presents at such a festival become debtors of the man who gives the feast. These feasts are celebrated at a marriage ceremony or when a man wishes to take a new name.

In connection with the remarks on the *potlatch*, Dawson refers to the actual condition of this people, and emphasizes the fact that the best way to civilize them will be the establishment of industries among them. The report on the legends of the people is of great interest, and so is the vocabulary of about seven hundred words, which is of great importance, as our knowledge of that language is very scanty.

## BOOK-REVIEWS.

*Great Waterfalls, Cataracts, and Geysers.* By JOHN GIBSON. New York, T. Nelson & Sons. 16°. $1.25.

*Chips from the Earth's Crust.* By JOHN GIBSON. New York, T. Nelson & Sons. 16°. $1.25.

THESE two publications present in a readable form certain phenomena of physical geography; the former treating of famous cataracts and geysers, the latter with a variety of geological phenomena such as obtrude themselves upon the attention of the reading public. The book on waterfalls and geysers is well illustrated, and the author has described almost exclusively those cataracts of which he was able to give an illustration. The papers of which the 'Chips from the Earth's Crust' consist were originally contributions to the *Scotsman* newspaper. Eruptions of volcanoes, great land-slides, tornadoes, discoveries of new gold-fields, the fall of a meteor, earthquakes, and similar phenomena, have given occasion to writing these papers; and we think the author has well accomplished his task to write in an agreeable form to such people as have no time and occasion for systematic study, but want to know what has been discovered regarding the history of the earth and the cause and true character of current geological events. The book contains a considerable number of illustrations.

*Mineral Resources of the United States.* By DAVID T. DAY. Washington, Government. 8°.

THE annual report on the mineral resources of the United States for the year 1886, compiled in the Division of Mining Statistics and Technology of the United States Geological Survey, has just been issued. We find in this volume, which is the fourth of the series, a minute and exhaustive report on the production and economic value of minerals in the United States. The arrangement is according to materials, and under each heading the total production, recently opened mines, technical improvements, imports and exports, are treated. The statistical tables of the preceding volumes have been brought forward to the close of 1886. Besides the report on the annual production, the volume contains a brief and interesting review on the American iron industry, from its beginning in 1619 to 1886, by James M. Swank, and an elaborate paper on the iron ores east of the Mississippi River, by John Birkinbine, to which are added analyses of foreign iron ores smelted in this country. The volume is very exhaustive, not only treating of metals, coal, petroleum, etc., but giving also a review of the production of structural materials, fertilizers, precious stones (the last by George F. Kunz); in short, of all minerals of any economic value.

*The Soul, or Rational Psychology.* By EMANUEL SWEDENBORG. Tr. by Frank Sewall. New York, New Church Board of Publ. 8°. $3.

THE original of this work is in Latin, and it remained in manuscript for a century before it was published; and now, after some forty years more, we have a translation of it in English. It is hard to see, however, what useful purpose the book can be made to serve. It is true that the present interest in psychological studies is great, and men engaged in them are glad to receive help from any quarter. But they will not get any help from Swedenborg, owing to the unscientific character of his work. Every one, whether he knows much of Swedenborg or not, has heard of him as a mystic and as the founder of a religious sect. Now, mysticism, as Mill somewhere remarks, consists in attributing outward reality to the creations of our own fancy; and that this is the method of Swedenborg, a few examples of his work will show. He assumes that we possess a lower mind or *animus*, a rational mind or *mens*, and a soul or *anima*, and these are perpetually spoken of by him as if they were distinct entities. Precisely how he does regard them it is impossible to say, for his expression is obscure; but the following passage from the appendix to the present work, and which is taken from another of his treatises, presents his doctrine briefly in his own words: "The first of the organs is the spirituous fluid, or soul, whose office it is to represent the universe, to have intuition of ends, to be conscious, and principally to determine. The next organ under the soul is the mind, whose office it is to understand, to think, and to will. The third in order is the *animus*, whose office it is to conceive, to imagine, and to desire" (p. 357). Besides all these 'organs,' he speaks of something which he calls the 'pure intellect,' his description of which is so obscure that we confess ourselves unable to understand what he means by the term. The translator of the work thinks it is entitled to credit for recognizing the part played by the brain and the body generally in connection with mental phenomena; but, unfortunately for this view, Swedenborg's anatomy and physiology are quite as fantastic as his psychology. Thus, at the very beginning of his book, he undertakes to explain "the successive formation of the blood-vessels from the simple fibre," and he begins as follows: —

"The simplest fibre is the form of forms, or that which forms the other fibres succeeding in order. The simplest fibre by its circumflexion forms a certain perpetually spiral surface, or membrane, which is itself the second, the medullary or nervous fibre of the body, and is simply a little channel constructed from the simplest fibre, but, together with the fluid which permeates it, constituting a fibre. . . . This fibre, when it falls into the provinces of the body, again forms a kind of little gland not unlike the cortical, from which proceeds the bodily fibre, and this forms the little tunic which infolds the arterial vessels" (p. 3). And there is much more of the same sort. Now, those who believe Swedenborg to have been a divinely inspired teacher may perhaps accept such doctrines as these and such methods as their author employs; but to other persons his book will be chiefly interesting as an example of the aberrations of the human intellect.

*Childhood: its Care and Culture.* By MARY ALLEN WEST. Chicago, Woman's Temp. Publ. Assoc. 8°.

IN estimating the value of such a work as this, the public for which it is intended is a prime consideration. The scientific man will find little in it likely to attract him, and what there is he can find in a better shape elsewhere. But the majority of mankind are not of a scientific turn of mind, and, as they have the practical problem of educating their own children before them, it is both natural and advisable that they should have prepared for them a general treatise on the nature of childhood, answering a want analogous to that satisfied by works on home medicine. The spirit in which such works are written is always a reflex of the movement appealing most strongly to the leaders of culture. It is not difficult to trace in this large volume the influence of new and to a great extent better views upon such questions as the moral training of the young by means of the every-day usages of society, the proper dressing of children, the dangers surrounding them at critical stages in their development, and so on. Some rather objectionable features that are also new have likewise found their way into the work. Chief among these is the early acquaintance of children with the dangers of alcohol, — a topic ridiculously overdrawn. In brief, this handbook aims to put together, in a style apt to attract the uninformed reader, the views of childhood now considered as most satisfactory; taking much from the development known as 'infant psychology,' piecing in somewhat of child-lore and anthropology, and systematizing much of such information as is often found in a magazine like *Babyhood*. In doing this there are many mistakes, some serious and some not; but, on the whole, the work leaves one with the impression that it is more remarkable that it is not less satisfactorily performed than that it is not more so. The chief characteristic that marks off such a treatise from a scientific one, is that the former brings in so much irrelevant matter: it is not false, not uninteresting, but out of place. However, there is undoubtedly a taste for works of this kind, and we ought to be satisfied if they are no worse than this.

*Life of Thomas Hopkins Gallaudet.* By his son, EDWARD MINER GALLAUDET. New York, Holt. 12°.

THIS book is an interesting account of a worthy and useful man. It is written with filial reverence and affection, but, so far as we can judge, without undue bias; and the story is well told. Mr. T. H. Gallaudet was the founder of deaf-mute instruction in America, and the principal interest of his biography arises from this fact. Few among the charitable or educational improvements of modern times are more important than that which has enabled persons without the sense of hearing, to communicate with their fellow-men; and, though Mr. Gallaudet was not the inventor of the system, he was the principal agent in introducing it into this country. It was during the second decade of this century that he became interested in the subject, while he was a theological student at Andover, and, at the request of a number of other persons who became interested with him, he abandoned the idea of entering the ministry, and started for London to learn the methods in use in the school for deaf-mutes established there. To his surprise, however, he found that the teaching of deaf-mutes in England was a virtual monopoly in the hands of a certain family, the members of which refused to allow him to learn the system, lest their interest should thereby suffer. After trying for some time in vain to induce them to change their mind, or to obtain any means whatever of learning their system of teaching, he went to Paris, where he readily obtained access to the information he wanted at the Royal School for Deaf-Mutes. Returning as soon as he had qualified himself, he opened the first school of the kind in this country at Hartford, Conn., in 1817, and continued for many years to preside over it as its principal. His duties, however, were somewhat arduous, and his relations with the directors were not always harmonious; and after a while he resigned his position. During the rest of his life he was engaged in various charitable and educational enterprises. He married one of his own deaf-mute pupils, and there is abundant evidence in these pages that she became an excellent wife and mother. His son, the author of this biography, is continuing his father's work, being now the president of the National College for Deaf-Mutes in Washington. During the present year the deaf-mutes of the country will erect a statue of the elder Gallaudet on the grounds of the college at Washington, — a tribute to his memory that is well deserved.

*An Explanatory Digest of Professor Fawcett's 'Manual of Political Economy.'* By CYRIL A. WATERS. New York, Macmillan. 12°. 70 cents.

THIS little book is intended chiefly for those students who are preparing for examination in Professor Fawcett's work in the English schools and colleges, and for this purpose it seems to be well adapted. It fills some eighty pages, and gives an excellent summary of the original work in clear and intelligible language, the more important doctrines and arguments being given in many cases very nearly in Professor Fawcett's own words. The original work is in many respects one of the best of the shorter treatises on the science, but it contains some doctrines that are not accepted now by the majority of thinkers, that of the wages fund being the most important. Mr. Waters objects occasionally to some of Fawcett's views, and indicates one or two deficiencies in the professor's work; but he says nothing on the subject of the wages fund. Fawcett's

work may be regarded as a briefer presentation of the doctrines taught by Mill, and hence this digest will serve to a certain extent as a summary of Mill's work also.

*What Shall we Talk About?* New York, T. Nelson & Sons. 16°. $1.

THIS is one of the old-style educational books, in which some parents or grand-parents entertain a party of children with wise and instructive stories and adventures. The present volume treats in this style a great variety of subjects referring to natural science. Descriptions of animal life, and anecdotes, come in for a large share of the space; but, besides, astronomical and physical phenomena are explained. We fear that some of the subjects treated, as well as the style of the book, are quite beyond the grasp of children as young as those for whom it is intended. The treatise on the physical properties of air on p. 139, to point out one instance, cannot be understood by children. The author neglects throughout the book to stimulate the power of observation, and gives theories instead. Besides, the cursory way in which phenomena having no connection whatever are treated without order and regularity must be rejected from an educational standpoint, as it promotes superficialness.

*A Text-Book of Algebra.* By W. S. ALDIS. Oxford, Clarendon Pr. 12°. $1.90.

THE present work is in its general plan similar to that of Professor Chrystol, published in 1886. While containing many of the new methods and conceptions which render the latter work so valuable, Aldis's work is less exhaustive than Chrystols', and does not depart so far from the ordinary text-books in general use as Chrystols' does. On this account it is better suited to teachers and students familiar with the rudiments of algebra. Indeed, the book is one which should be in the hands of every mathematical teacher in a high school, academy, or college in the country. It is only by the help of such works as the present one that mathematical education can be raised to a higher standard than it at present possesses.

The peculiar excellences of the book are found in the two opening chapters, which together occupy fifty-one pages. The book begins with a thorough discussion of arithmetical ideas. The process of counting leads to the idea of positive integers; thence addition, and its inverse operation subtraction, arise; next come multiplication, and its inverse division. By division we are led to the idea of fractions.

Chapter II. is devoted to algebraic notation. By subtraction we are led to the idea of negative numbers. The laws governing such numbers are fully discussed and carefully illustrated.

At the end of the second chapter is introduced a brief treatment of vector quantities: this is introduced simply to show the student that "algebra is something very much wider in its scope than a mere substitution of letters for numbers to aid in the solution of general arithmetical problems." These words are the author's own.

The remainder of the book differs little from the well-known text-book of Todhunter. The last chapter, on choice, might have been extended with advantage.

The book is marred by clumsy and faulty language. Many of the definitions lack precision, and many terms are introduced without definition. Some words are made to have two inconsistent meanings.

## NOTES AND NEWS.

THE first number of the *Internationales Archiv für Ethnographie* has just been issued. The new journal is edited by J. D. E. Schmeltz, curator of the National Ethnographical Museum at Leyden. It is novel in plan, being exclusively devoted to the discussion of the ethnographic specimens collected among the various tribes and races. The journal will make accessible by illustrations the collections deposited in the various museums of the world. The text will contain papers in French, English, German, and Dutch, according to the choice of the author. The subjects of the papers will be the ethnographical results of expeditions, descriptions of newly discovered ethnographical objects, and studies of collections. Objects the origin of which is doubtful will be figured and discussed. The plan of the journal includes also the study of prehistoric remains. As the material for ethnographical studies is so widely scattered in private and public collections, the establishment of such a journal must be welcomed by all students of the science of man. In order to make it the centre of such studies, a number of co-editors in various countries contribute to the journal. The first number shows that the journal will be of the greatest value. Three beautiful chromolithographic plates and a number of cuts illustrate the text. The plates show a large collection of New Guinea arrows, to illustrate a paper by Dr. L. Serrurier, in which the various forms of arrows of this large island are ably discussed, and the principal object of which is to show that only a large collection will enable us to determine the typical forms of ethnographical objects, and to draw reliable conclusions. The third plate is devoted to the mandaus, the sword of the Dayak, the manufacture and ornaments of which are described in detail by S. W. Tromp. This paper is illustrated by a series of cuts showing the ornaments and various forms of handles. The rest of the paper is taken up by notes on recent additions to collections, a bibliographical review, and a discussion of objects of doubtful origin. The periodical is to appear bimonthly, and each number will contain about twenty-four pages text in quarto, and three chromolithographs. The journal is published by O. W. M. Trap, Leyden.

— The most interesting feature of the twenty-first report of the trustees of the Peabody Museum is Professor Putnam's report on the purchase of the Serpent Mound in Adams County, O., for which a number of ladies of Boston subscribed a sum of nearly six thousand dollars, and on the steps taken to secure the preservation of the interesting monument. Eight weeks were given to the careful restoration of the great earthwork, erecting a fence about it, so that only persons on foot can enter the enclosure. The land was cleared of brush and briers, and the mound was sown with blue-grass-seed. A road half a mile long was made, extending to a grove of maples in the south-eastern corner of the grounds, in which are two springs. This grove has also been enclosed by a fence. A substantial spring-house of stone has been built, and trees are now being planted along the road. A gravel path has been laid out from the spring to the serpent, and various other improvements have been made. It is highly gratifying that Professor Putnam has succeeded in preserving this remarkable monument, and the liberal action of the subscribers will undoubtedly be a material help to future endeavors to preserve ancient monuments in the United States. Several changes have taken place in the board of trustees of the museum: Col. Theodore Lyman resigned his trusteeship, and Mr. Samuel H. Scudder was elected his successor. George F. Hoar, who resigned the presidency of the American Antiquarian Society, was succeeded by Stephen Salisbury. Professor Putnam became trustee as president of the Boston Society of Natural History. Professor Gray was succeeded by Professor Lovering, president of the American Academy of Arts and Sciences.

— A new thermometer for measuring the temperature of the air has been constructed by R. Assmann. In order to protect it from the influences of radiation and other sources of heat, he inserts the bulb of the thermometer in a metal tube which is open at its lower end. An aspirator is fastened to the tube near the bulb, and a continuous current of air of about seven feet velocity passes the latter. Thus it assumes the true temperature of the air. The tube is made of highly polished nickel-plated brass in order to protect it from radiation. Experiments show that this thermometer gives entire satisfaction. Two instruments, one of which was exposed to the sun in July while the other was shadowed, showed the same temperature. A dry and a wet thermometer being inserted in the tube, it serves as hygrometer in the same way as the ordinary thermometer. Undoubtedly the device is superior to the arrangement of thermometer now in general use.

— Prof. David S. Martin is about to publish the large-scale geological map of the environs of New York City, which he exhibited at the recent meeting of the American Association for the Advancement of Science. The object is to furnish a map in which all those important geological features which were not before brought together in one representation, can be clearly seen by an audience or

a class. The coloring will be the same as in Hitchcock's geological map of the United States.

— The *Journal of the Royal Society of New South Wales* for 1886 contains a very interesting sketch of the history of the floods in Lake George, by H. C. Russell. The lake has no outlet, and since its discovery in 1820 it has been dry twice. According to reports of the natives, the basin contained no water for some time previous to 1820. In 1823 it reached its highest level, attaining a maximum depth of twenty-four feet. Then it commenced to dry up, and in 1838 and 1839 it contained no water. In 1840 four feet of water were found in the basin, which, however, from 1845 to 1849, was again completely dry. During the ensuing ten years the lake began to fill, but in 1859 it was dry for the third time. Since that time it steadily increased in size until 1874, when it reached the same height as in 1823. This record is of great interest, as it shows the alternating periods of humidity and dryness. It is particularly important in connection with Seibt's and Brückner's studies of similar changes in the levels of lakes in the northern hemisphere, which were noticed in No. 232 of *Science*. Brückner arrived at the conclusion that the whole of the northern hemisphere passed through a dry period between 1830 and 1840. This was followed by a period of increased humidity about 1850. A new dry period developed between 1860 and 1865, while after 1875 the precipitation increased. The periodical changes of Lake George agree with these results. From these and several other facts, Brückner infers, in reviewing Russell's paper, that the whole earth takes part in these periodical changes.

— Domingos Soares Ferreira Penna, the Brazilian naturalist, died at Pará, Brazil, on the 8th of January. During the last twenty-five or thirty years not a naturalist has done any work in the Amazon region who is not more or less indebted to Snr. Penna in one way or another. Agassiz and Hartt and the members of the late geological survey of Brazil were greatly aided by his valuable personal knowledge of the region, and by his useful suggestions. He was at one time secretary of the province of Pará, and at the time of his death was director of the Provincial Museum at Pará.

## LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

*Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

### Ratio between Men and Women.

PROF. W. K. BROOKS of Baltimore has discovered that a favorable environment tends to produce an excess of females among animals and plants, and an unfavorable environment an excess of males. If this be true, a race or species which is on the point of extinction should have an excess of males.

The population of Australia consists of a small and decreasing number of aborigines, and a prosperous and increasing population of foreign settlers and their descendants, amounting, in all, to nearly three millions of persons. As the native population is rapidly disappearing, we should expect to find the males more numerous among them, as compared with the females, than among the inhabitants of foreign origin, provided other conditions are equal. For each 100 females there were in Victoria, of native-born Australians, $100\frac{2}{10}$ males; and of foreigners, exclusive of Chinese, $129\frac{1}{10}$ males. The ratio of males to females in the population of foreign origin is therefore very much greater than it would be if it depended upon the birth-rate alone; and, as this modifying influence does not affect the aborigines, an excess of males among them no greater or even a little less than that found among the inhabitants of foreign origin would indicate that the excess of male births is much greater among them than among the people of foreign origin. Computation shows that the excess of males among the aborigines is, notwithstanding these neutralizing influences, very much greater than it is among the foreign population.

For all Australia there are 143.72 aboriginal males to each 100 females; there are only 118.64 males of foreign descent to each 100 females, notwithstanding the fact that 129 males settle in these colonies to each 100 females.

To those who wish to follow this subject further, it may be interesting to know that an enormous collection of statistics relative to the Indian tribes of the United States was made under the direction of Maj. J. W. Powell. The results of this census have not been published, but the material is still available, and would furnish a much better basis of comparison than the one chosen by Professor Brooks. O. T. MASON.

Washington, D.C., Feb. 27.

### Classification of Diphtheria.

THERE is a very striking resemblance between the membrane of diphtheria and the fungi that produce dry rot, or more especially those forms that grow in living trees. A white or yellow leathery substance is produced, sometimes known as 'punk,' — the *Merulius lachrymalis* in dead wood, and some species of *Polyporus* in the living. The hyphæ, or roots, penetrate the cells of the wood in every direction, producing disintegration and decay.

Diphtheria is called an exudation, and classed as a bacterial disease, a *Schizomycetes*, when in fact it is a fungus of a higher order, a *Hyphomycetes*. It grows on the surface, and spreads by fibulations, and its roots penetrate deeply into the tissue, producing changes and decomposition, which becomes the soil for bacteria, generating poisons that are absorbed and powerfully affect the whole system. In this view its life-history has not been studied or found out. It is known that the membrane can be transplanted, and that the surface abrasions on which it grows are of a painful, smarting kind. How it is propagated by spores is unknown. There is evidently some peculiar condition required, as in the *Merulius*, which will not grow unless an alkali is present. It may be that an alkaline condition of the system is required, which is the reason of the capriciousness of its infection.

The treatment of the disease in this light assumes a new aspect, and gives purpose to thorough local antiseptic applications; i.e., thorough eradication of the fungi before it can have time to poison the system. P. J. FARNSWORTH.

Clinton, Io., Feb. 22.

### Sex and Consumption.

I WAS delighted at seeing the main tendency of the article on sex and consumption, that appeared in *Science* of Feb. 3. The views that I have since 1882 been trying in vain to get investigated here, appear to be receiving serious attention in your great country. That this progress in a question of nothing less than the life or death of a large multitude of the civilized world may not be checked by the presence of one or two erroneous inferences in that article, I shall be glad if you will permit me to point them out.

Although for the present time it is true that the total male mortality exceeds that of the female, yet that neither applies to all periods of life, nor is the difference so great as to justify the term 'protected' to the female in any sense. From the age of five to fifteen, the female mortality from consumption is much greater than that of the male, and it is in the later periods of life that the latter preponderates. Further, in the strictly rural districts the female mortality exceeds that of the male; and it is only within a comparatively recent period that the total male mortality has exceeded that of the female, and that has been brought about by men who had been brought up and engaged in country pursuits, rushing into town employments. One word more. An organ that is subject to hyperæmia does not gradually waste away, and hence we must look elsewhere for an explanation of the mode in which those conditions of our civilization that tend to reduce the capacity of the chest produce consumption. G. W. HAMBLETON.

London, Feb. 16.

### A Worm in a Hen's Egg.

THE nematoid worm sometimes found in the white of the hen's egg is not *Ascaris lumbricoides*, as your correspondent of last week supposes, but a *Heterakis*, generally *H. inflexa*, the normal habitat of which is the fowl's intestine, but which occasionally wanders into the oviduct. R. RAMSAY WRIGHT.

Toronto, Ont., Feb. 28.

### Calls for Domestic Animals.

IN reply to Mr. H. Carrington Bolton's query in relation to terms used in addressing domesticated animals, I beg leave to give information regarding the terms used by the Eskimo of Cumberland Sound and Davis Strait in addressing dogs. To start dogs, a whistling sound made in the throat, and strongly aspirated, something like *h! h!* is used. For urging the dogs, a great variety of terms are used, the most common of which are the following, expressed in the phonetic alphabet of the Bureau of Ethnology: *ak* (the *k* being very guttural); *yatit; ut̄* (the *i* pronounced in a very high key, and lasting from about five to ten seconds); *a* (pronounced in a similar way); *yauksa kōksa;* the same sound as the one used in starting the dogs. For stopping the dogs, a deep *ō*, drawn very long, is used; for making them lie down, a similar *ō* spoken in a low voice, and at the same time the whip is gently thrown over their heads. In order to turn to the right, the driver sings out, *au'a au'a ya au'a*, throwing the whip to the left; to turn to the left, the term *qoï'a qoï'a ya qoï'a* is used. For driving dogs from some food or other things they may attack, the term *ha!* preceded by the name of the dog, is used. DR. F. BOAS.

New York, Feb. 20.

### Vermin-Eaters.

CERTAIN aborigines of South America are addicted to a peculiarly disgusting habit, as the following extract from A. Simson's 'Travels in the Wilds of Ecuador' attests: "Lice of different species are the most abundant, and it is among the commonest sights to see the inhabitants engaged in their chase, keenly pursuing them in each other's heads, and cracking them, when captured, between their teeth" (p. 9). It is interesting to compare this with the evidence of a traveller in another part of the globe. Octavius G. Stone, in 'A Few Months in New Guinea' (Franklin Square Library edition), says, "A very favorite pastime, particularly of the women, is hunting in each other's heads for vermin. Two, three, or four in a row, sitting one behind the other, might be constantly seen in front of my tent, pursuing their favorite amusement. It is a common one among most colored races, and a wholesome practice to boot. But *eating* the lice is another affair. I could hardly believe my own eyes when I first saw them engaged in this disgusting employment; yet they not only eat every one caught, but appear to do it with considerable zest and relish. Whether they believe it nourishing, or take it simply as a *bonne bouche*, is not quite certain, but opinion inclines toward the latter theory" (p. 11). Whether this be the correct explanation or not, remains to be seen. Certainly it is not for lack of food that the practice is kept up. Is the practice known to exist elsewhere in America? The tribes visited by Mr. Simson were the Piojes and Jivaros; those seen by Mr. Stone belonged to the Motu district of New Guinea. Perhaps when all instances of the occurrence of this strange habit have been collated and examined, a clear and satisfactory explanation of it may be given. In the mean time, I simply call attention to this interesting point in the anthropology of the Naturvölker.

A. F. CHAMBERLAIN.

Toronto, Feb. 15.

IN addition to Mr. Chamberlain's quotations, I would say that the custom of eating vermin is a wide-spread one, although most travellers do not mention it in their reports. Parry and Lyon, as well as Hall, found it practised by the Eskimo of Hudson Bay and Frobisher Strait. I found the same habit among the Eskimo of Cumberland Sound and Davis Strait, and I well remember a father carrying his three-year-old child, and feeding it with the lice he picked from its head. F. BOAS.

New York, Feb. 25.

### The Snow-Snake and the r-Sound.

DR. BEAUCHAMP will, I am sure, agree with me that the presence of the snow-snake game among the Southern Iroquoian tribes can be more firmly established by the evidence to be obtained directly from the traditions of those Tuscaroras who early in the present century came directly from the South to their present habitation in Niagara County, N.Y., and by the evidence of language, than in any other way.

In these traditions the *Tci-ru-hă'-kā'* (the Nottowayans), among others, are mentioned as contestants with the *Skă-ru'-rĕⁿ'* (Tuscaroras) in this game of snow-snake.

The name of the so-called 'snow-snake' in the language of the Tuscaroras is *u-tră-hwĕⁿ-tĕ* (misprinted in my former article); and of the game, *nä-yä-tră-hwĕⁿ-tă'-yĕñs* (literally, 'they two bet snow-snake'). *U-tră-hwĕⁿ'-tĕ* is a pure noun, having the power of composition either with verbs or adjectives, and also having a declension to express the nominative and oblique cases, — circumstances that in the nature of the language assign to the noun an age far antedating the wars of 1711-13. The game was played in winter, and a slight modification of it in the summer.

The southern limit of snow at sea-level is, in the United States, the 30th parallel of northern latitude; and, as the territory of the Southern Iroquoian tribes lay between the 35th and 39th parallels, it is quite likely that they often had winters 'appropriate' for the use of the snow-snake.

With the assistance of some very intelligent Onondagas, some of whom spoke Tuscarora and Oneida in addition to their own tongue, I collected, in 1880 and 1884, with other linguistic matter, a vocabulary of more than fifteen hundred words and over five hundred and fifty phrases and sentences, and I also made translations of two quite lengthy aboriginal compositions. In the prosecution of these linguistic studies, great care was taken in verifying the work at every stage of it. No *Onondagan* word was found in which the *r*-sound was used.

Mr. Albert Cusick, a man of intelligence and education, was one of my assistants in these investigations.

The Onondagan, like the Senecan, tongue of to-day has either transmuted the *r*-sound into an aspirate, or has simply suppressed it.

Mr. Horatio Hale, the eminent linguist and ethnologist, says (*Book of Rites*, p. 46), "In former times, as we know from Jesuit vocabularies, the sound of the letter *r* existed in the Onondagan dialect. Since their day the sound has disappeared from it entirely."

Dr. Daniel Wilson, in his lecture on the Huron-Iroquois of Canada (*Trans. Roy. Soc. of Canada*, 1884, Sec. II. p. 105), states that the *r*-sound is "no longer heard" in the Onondagan tongue.

No one denies that the *r*-sound once existed in the speech of the Onondagas, as it is still common to nearly all of the cognate dialects.

The orthographies and translations of both Schoolcraft and Zeisberger are so inaccurate and untrustworthy that it seems strange to see them quoted as authority on a point of phonetics requiring precision and accuracy of observation, and record of language, for its proper determination.

Dr. Beauchamp says that in a version of the Lord's Prayer sent to him by a native Onondaga in that tongue, "the letter in question frequently occurred, but the sound was obscure. I went over the version with him syllable by syllable, to get the exact sound, and retained the letter four times as clearly enunciated."

Faulty articulation quite probably accounts for these four *r*'s retained by the doctor.

In the summer of 1884, I obtained from living Onondagas, and not from 'lifeless books,' a version of the Lord's Prayer in which the *r*-sound does not once occur.

One difficulty experienced in my work was to obtain the Onondagan orthoepy of a word. The intercommingling with the Onondagas, of persons speaking cognate languages in which some form of the *r*-sound occurs, is in many instances the cause of the unconscious mispronunciation of a word.

To the student of Iroquoian tongues faulty articulation, worse orthography, and *otosis* (defective hearing) are fruitful sources of error.

Every Indian is not competent to furnish satisfactory linguistic data. Equally deficient are many collectors of vocabularies and linguistic material.

Recognizing these difficulties, the Rev. Ashur Wright, who knew well what Iroquoian orthoepy and orthography require, says, on the sixth page of his valuable Senecan spelling-book, printed in 1842, "It is sometimes, also, very difficult to decide on the correct usage,

where there are differences of pronunciation among the Indians. In such cases we have sought for the pure Seneca in contradistinction from the *idioms of Mohawk, Cayuga, Onondaga*, etc., and for Seneca as spoken by the old men."

With these facts in view, I cannot accept Dr. Beauchamp's use of the *r*-sound in his orthography *ka-wher-tah* for *kă-whe"-tă'*.

J. N. B. HEWITT.

Washington, D.C., Feb. 18.

## Queries.

29. THE JACKSON MEDALS. — In 1874 or 1875 a farmer brought to this city and sold to Mr. W. H. Daum a silver medal which his boys found in a stone tumulus, supposed to be the grave of Little Bear, an Osage chief. The medal is three inches in diameter, has on its face the profile of Jackson, with the words, "Andrew Jackson, President of the United States, A.D. 1829," and on the reverse a pipe and a tomahawk crossed, two hands clasped, — one that of an Indian, and the other of the President, — and the words "peace and friendship." Can you or any of the readers of *Science* tell me why these medals were given to the Indians, and whether the practice is a common one? L. C. WOOSTER.

Eureka, Kan., Feb. 23.

## Answers.

26. THE EARTH'S ROTATION AS AFFECTING RAILWAY-TRAINS. — Mr. Goodridge will find a partial answer to his query, in 'The Annual Report of the Chief Signal Officer for 1885,' Part II., which forms W. Ferrel's 'Recent Advances in Meteorology,' p. 191. After having shown that a body moving in any direction on the earth's surface is deflected, and giving the formulas for computing the deflecting force, the example is treated, "If a railroad-train on the parallel of 45° runs at the rate of forty miles per hour, what would be the lateral pressure per ton of the weight of the train on the side of the rails if both were on the same level?" and the answer is given that it would be 0.38 of a pound per ton of two thousand pounds. In reply to this query, a writer in *Engineering News* quotes the famous 'Bär's law' regarding deflection of rivers. Ferrel's formula shows that the action of the earth's rotation is not at all confined to a body moving in the direction of the meridian, as this writer also assumes. Ferrel gives an example of this kind, and finds that a river one mile in width, flowing in latitude 45° at the rate of four miles per hour, will be 1.2 inches higher at the right-hand bank than at the left-hand bank. F. B.

New York, Feb. 25.

21. GLOBULAR LIGHTNING. — Apropos of this subject, let me mention three cases which have come to my knowledge in such a way as to inspire confidence in them. The first in order of time occurred about 1859 or 1860, and was witnessed by a lady, the wife of a prominent physician. She was lying down for an after-dinner nap one summer day. From her letter I quote what seems pertinent: "The experience was this, and at The Forest Grove House, Schooley's Mountains. . . . We were aroused by a sudden and quite heavy hail-storm. . . . I immediately went to the open window, putting it down, leaving just space enough to put out my hands, in which I enjoyed the fun of catching the stones to eat. . . . This was only for a few minutes, when we were terribly startled by a flash of lightning and a peal of thunder, and I saw what appeared to be a ball of fire the size of my head come down the body of a tree about three yards from my hands. . . . The flash, the thunder, and the ball seemed simultaneous. . . . The tree did not afterward show the usual appearance of being struck, except just at the roots, where the ground was torn up for quite a little distance. . . . The house was struck at the same time and set on fire at the roof, but at its farthest point from us. . . . I was the only one who saw the ball of fire, but I have never doubted that I really did see it. . . . It was too plainly before my very eyes." The second case occurred a few miles north of Lambertville, N.J., in July, 1879. A barn was burned, and the company which had insured it instituted an investigation to determine the cause of the fire. From the testimony, I quote that of two men who swore that they saw "a cylindrical form of fire, apparently about three feet in diameter, and from six to eight feet in length, fall with a whizzing sound. . . . No thunder was heard, nor did any rain fall at that time. . . . Others also saw the strange occurrence." These men were in Pennsylvania, across the Delaware River, about a mile from the spot where the barn was burned. The third case was at Connersville, Ind., in August of 1881. Mr. L. L. Broaddus wrote me that it was about twenty minutes before four in the morning when the family and several neighbors were roused by a terrific crash. One of the neighbors, living nearly half a mile away, slept in a room from which she could see the Broaddus mansion. She saw a bolt strike a tree and burst like a bomb, scattering fire-balls over the yard, and brilliantly illuminating the premises. Mr. W. H. Broaddus and his wife slept on the side of the house where the tree was, and saw the 'second act;' that is, the fire-balls rolling about. They say the phenomenon lasted long enough for them to collect themselves and call occupants of other rooms, who, however, did not arrive in time to witness the display. The duration of the phenomenon was estimated by those who saw it at about a minute.

F. C. VAN DYCK.

New Brunswick, N.J., Feb. 20.

21. GLOBULAR LIGHTNING. — It may throw further light upon this interesting phenomenon to quote several additional reports received by the United States Hydrographic Office from masters of vessels; and, by permission of the hydrographer, I have selected the following as likely to be of interest in this connection. The phenomenon seems to be by no means unusual at sea, and perhaps some readers of *Science* who have devoted special attention to the study of electricity will contribute new facts or suggestions which may lead to a satisfactory explanation. The instances already cited (*Science*, x. p. 324, xi. pp. 38, 62), with those given below, would seem to furnish a very good basis upon which to build a theory. A further discussion will also be valuable as indicating, possibly, certain important details of observation which have hitherto been neglected, but which it might be practicable to attend to, even on shipboard. Captain Moore, British steamship 'Siberian,' in addition to the report already given, states that he encountered a severe electric storm Jan. 17, 1887, latitude 42° 50′ north, longitude 59° 14′ west; dark, gloomy weather, with rain and sleet. Between 8 and 9 P.M., during shift of wind from south-west to south-east, a brilliant display of St. Elmo's fire was observed, taking the shape of balls of fire shooting up from the horizon all around the vessel, and bursting at an altitude of about 5°. One ball, showing a green light, was mistaken for a vessel's side-light; brilliant lightning to the south-west. Captain Bowers, American bark 'Hannah McLoon,' encountered a severe electric storm Feb. 27, 1887, latitude 37° 17′ north, longitude 73° 56′ west, during a stormy gale from the south-west; all points and all wire rigging brilliantly illumined; fire-balls flying in the air. Captain Mitchell, British steamship 'Mentmore,' experienced a succession of terrific hurricanes from west-north-west during a voyage from Liverpool to Baltimore. Jan. 28, 1885, at 2.30 A.M., a ball of St. Elmo's fire fell between the bridge and foremast, and afterwards played upon the foremast and gaff. This ball of fire was so bright that for a time it blinded the officer on watch. Captain McKinnon, British brig 'Nellie Crosby,' encountered a remarkably severe electric storm Nov. 30, 1886, off Minot's Ledge light, Massachusetts, with terrific thunder and blinding lightning. A ball burst between the masts, completely blinding all on board; heavy rain; sea full of phosphorescence. Captain Sparks, American bark 'John H. Pierson,' reports witnessing an unusual phenomenon during a hurricane, Aug. 25, 1886, between the hours of 9 and 11 P.M. The sky was completely overcast, the weather dark and gloomy, and rain falling heavily. In the northern horizon, balls of fire were seen to shoot upwards, reaching an elevation of at least 30°, and covering a horizontal angle of at least 20°. The display continued at frequent intervals during the time mentioned. Captain Bodden, British schooner 'Clara L. Dyer,' reports that on Sept. 20, 1887, when in the Gulf of Mexico, about two hundred miles south by east from South Pass, had very heavy rain-squalls with thunder and lightning. The effect of the lightning was very peculiar, as it seemed to issue from the waves instead of from the heavens; thought at first it was due to the phosphorescence of the water, but the flashes seemed too plainly marked for that.

EVERETT HAYDEN.

U.S. Hydrographic Office, Feb. 20.